

# **Lecture**

## **Module 9: Biotic Communities**

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### **Learning Objectives**

Upon completion of this module, the participant will be able to:

1. Describe the various levels of biological diversity as related to the landscape features and processes.
2. Describe some of the primary and secondary factors affecting the distribution of organisms on the landscape.
3. Describe biotic community dynamics in relation to natural environmental forces.
4. Describe how biotic community dynamics relate to natural resource management alternatives.



### **Lecture Outline**

Objectives

Definitions

Numbers of species and extinction rates

Reasons for species decline

- Habitat loss and fragmentation

- Introduction of exotic organisms

- Over exploitation

- Natural causes

Concepts necessary for managers to understand in order to conserve species

- Species richness

- Patterns of species richness

  - Geographic factors (latitude, altitude, depth)

  - Environmental productivity

  - Environmental heterogeneity

  - Climatic variability

  - Age of the environment

  - Environmental harshness

Implications for conservation planning

- Some areas are more important than others

- Importance of private lands

Rare ecosystems (wetlands, tall grass prairie, late-successional stage forest)  
Planning on a watershed scale

## Exercises

### *Field or Classroom Exercises*

1. Develop a list of threatened and endangered species for your state. The local office of the U.S. Fish and Wildlife Service or your state fish and wildlife agency can help you with this. What are the reasons these species originally declined? Are there patterns of species endangerment (types of species, causes of decline, or habitats or localities that form a pattern for why these species need protection)? Obtain a recovery plan for one of these species. What specific management actions are required to recover the species and what level of conservation (genetic, population, community, landscape) are these actions targeting?
2. On land that you manage or are familiar with identify a community of organisms. List as many of these organisms as you can. What functional roles (i.e., predator, herbivore, decomposer, etc.) do each of these species play in your community? What might happen if an invasive organism (plant or animal) was introduced into your community? What might happen if the apex predator(s) was removed?
3. Think about species richness for a taxa of organisms (i.e., mammals, birds, reptiles, amphibians) in your state or region. What are some of the factors that determine the number of species? Which of any of these factors are subject to management? What can we do about the other factors if species richness is important to society?

4. On property that you manage or are familiar with, map the vegetation associations. You can use an aerial photograph for this purpose. For each vegetation association make a list of the characteristics (different vegetation layers, logs, snags, etc.) that determine the structural diversity of these associations. Is species richness on this property related to the vegetation associations? Why or why not?
  
5. Think about a watershed you are familiar with. Based on the information obtained in this course and using species richness as an environmental indicator of conservation priorities, what are the priority areas that you might recommend for conservation or restoration efforts? What are the constraints to applying conservation efforts to priority areas in this manner? Why might species richness be a poor metric to use in determining conservation priorities?

## **Study Questions**

1. Explain how geographic and environmental factors affect species richness and productivity. In what habitat type are the most numbers of species found on earth and why?
  
2. Why are private lands an important consideration for biological conservation goals?



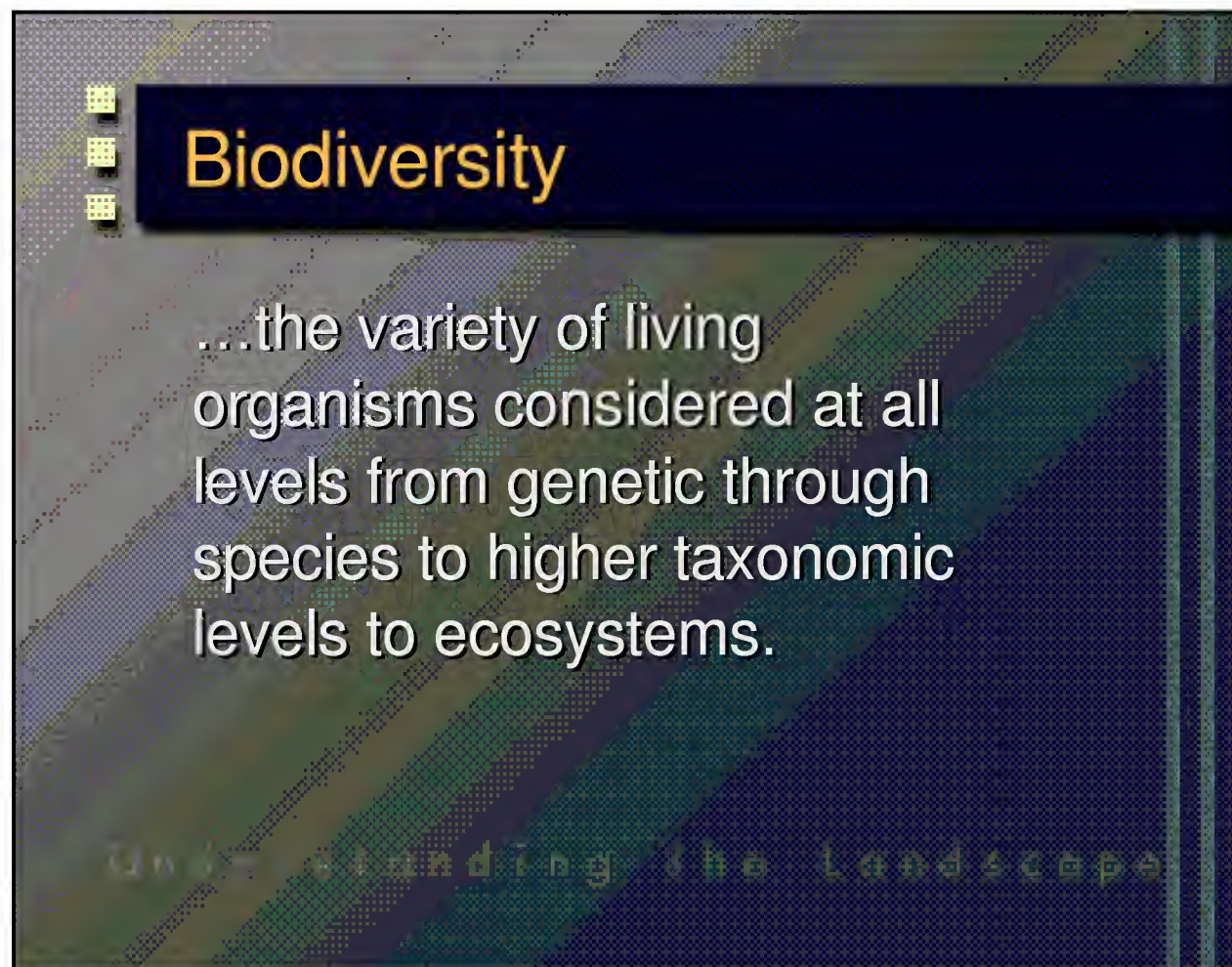
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## Slides used in lecture

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### Biodiversity

...the variety of living organisms considered at all levels from genetic through species to higher taxonomic levels to ecosystems.

Understanding the Landscape

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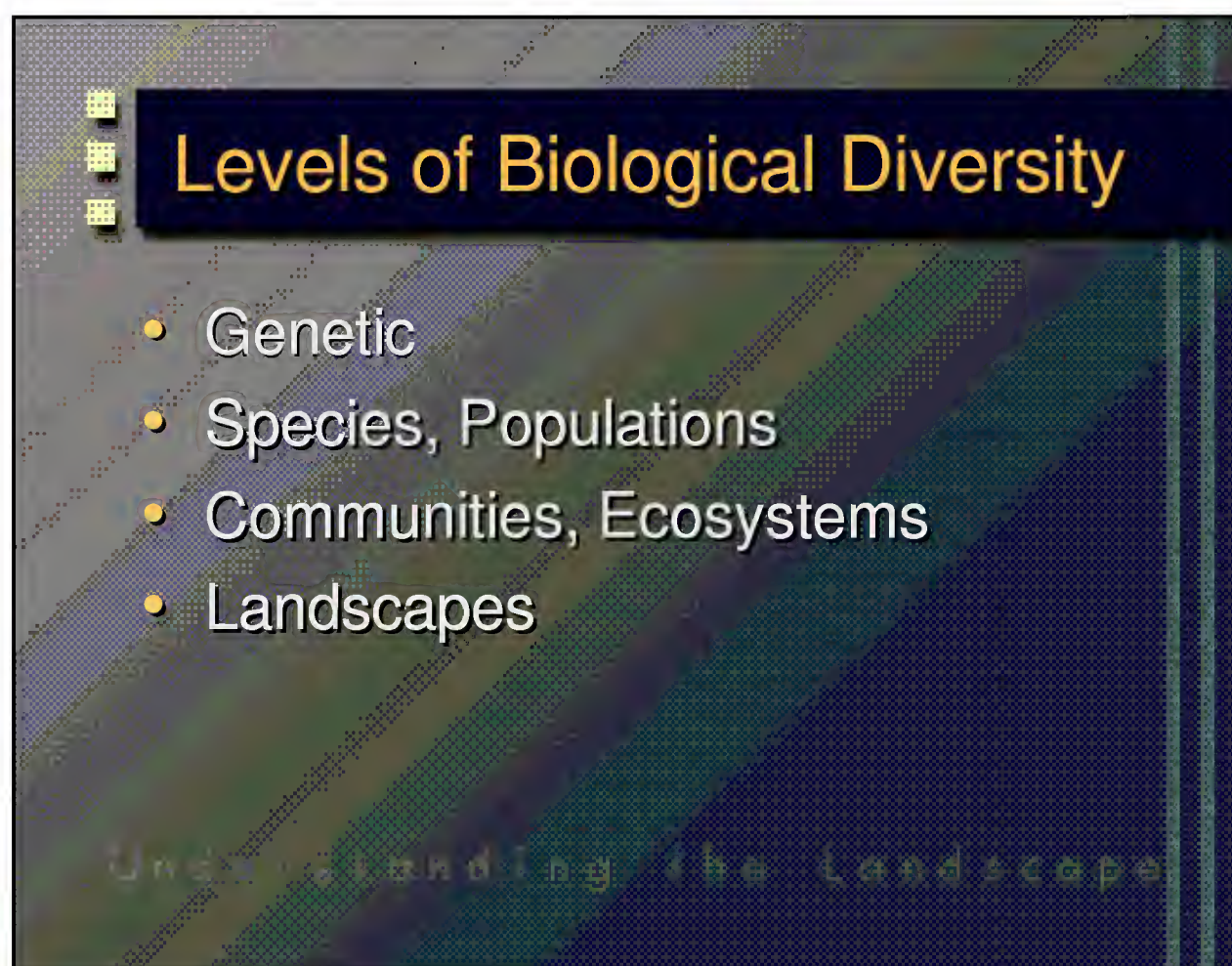
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### Levels of Biological Diversity

- Genetic
- Species, Populations
- Communities, Ecosystems
- Landscapes

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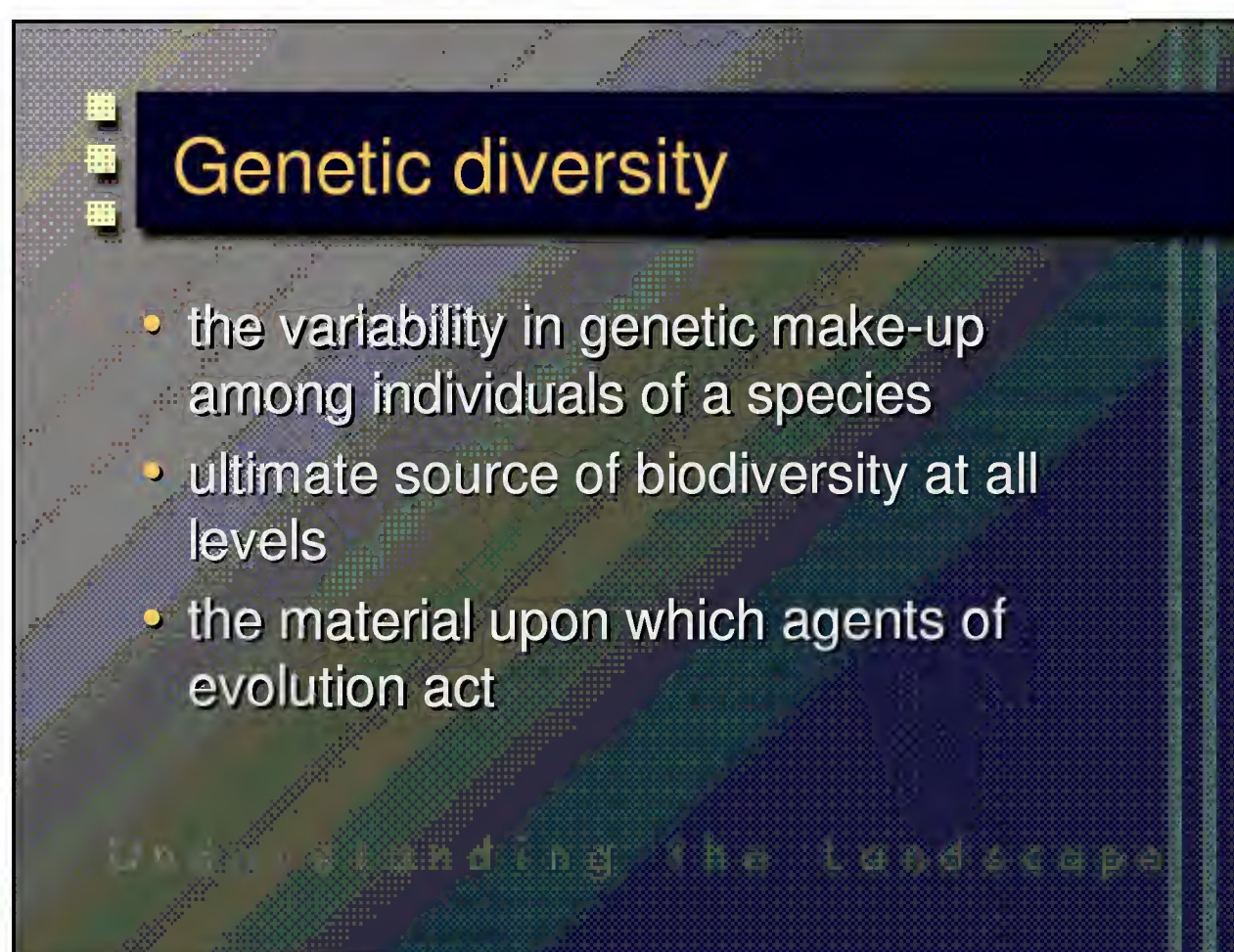
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### Genetic diversity

- the variability in genetic make-up among individuals of a species
- ultimate source of biodiversity at all levels
- the material upon which agents of evolution act

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### Species

...a group of actually or potentially interbreeding populations that are reproductively isolated from all other kinds of organisms.

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### Population

...a subgroup of interbreeding individuals within a species.

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### Evolutionarily Significant Units (ESU)

...a group of organisms that shares evolutionary lineage and contains the potential for a unique evolutionary future.

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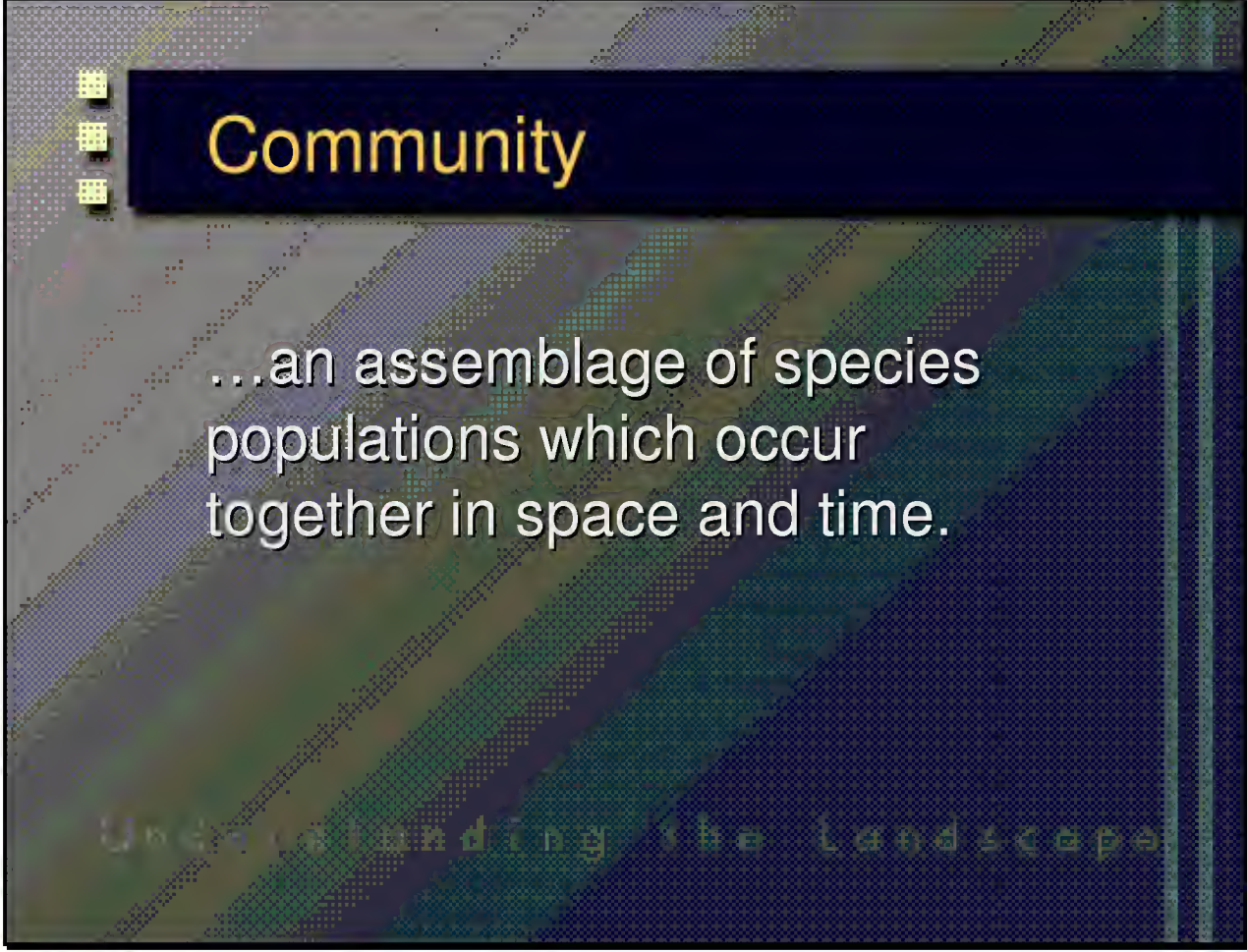
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Community

...an assemblage of species populations which occur together in space and time.

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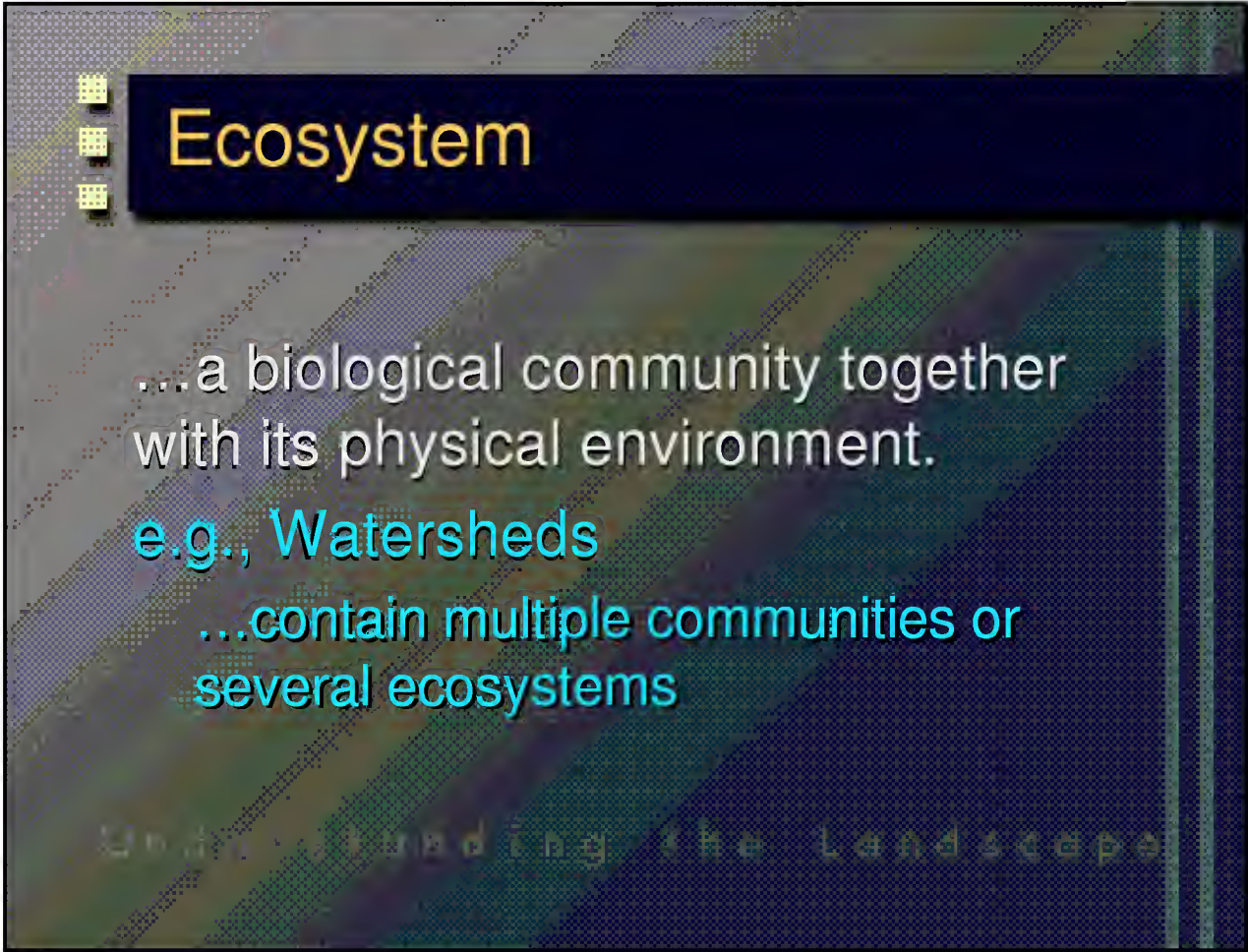
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Ecosystem

...a biological community together with its physical environment.

e.g., Watersheds

...contain multiple communities or several ecosystems

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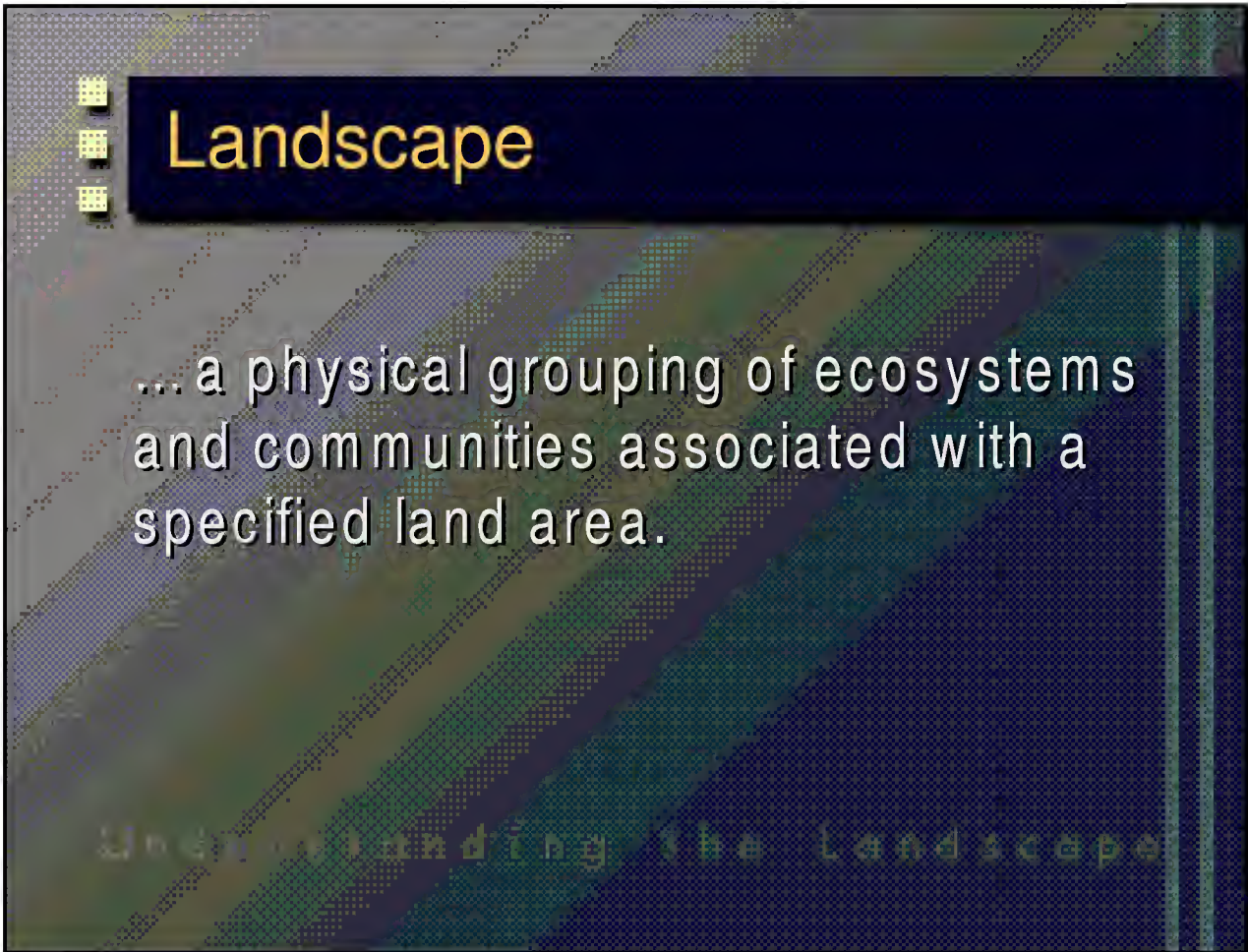
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Landscape

...a physical grouping of ecosystems and communities associated with a specified land area.

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Slide 10

How Many Species?

- **Number of species identified:**
  - 1.5 million
- **Total number of species**
  - ...10 million...
  - ...50 million...
  - ...100 million...

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Slide 11

How many species?

Taxon	Described species	Estimate number	Percent described
Fungi	80,000	1,500,000	5.3
Vascular plants	250,000	500,000	50
Roundworms	20,000	1,000,000	2
Arthropods	1,250,000	20,000,000	5
Vertebrates	40,000	50,000	80

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Slide 12

Estimated loss in near future

- 20% of all species in the next 20 years
- 50% of all species within 50 years

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A presentation slide with a dark background and a grid pattern. The title "Reasons for species declines" is in a yellow box. Below it is a bulleted list of four reasons. The text "Understanding the Landscape" is at the bottom.

### Reasons for species declines

- habitat loss and fragmentation
- introduced exotic organisms
- over exploitation
- natural causes

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A presentation slide with a dark background and a grid pattern. The title "What can land managers do?" is in a yellow box. Below it is a bulleted list of three points, with the last one having two sub-points. The text "Understanding the Landscape" is at the bottom.

### What can land managers do?

- Think about how species are spread out globally
- Gain a better understanding of the landscape which will
  - lead to better stewardship of habitat
  - Help conserve species richness and biological diversity

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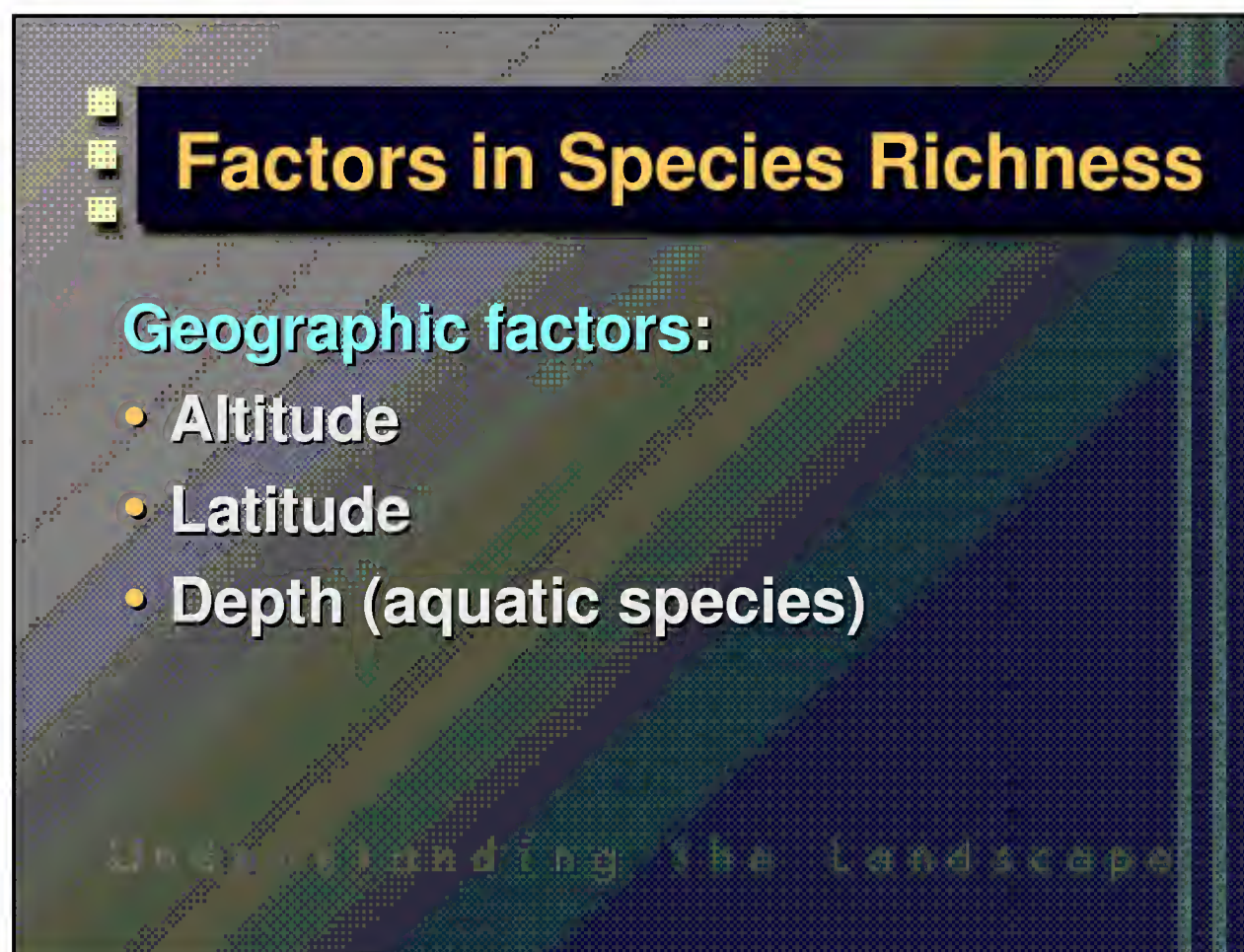
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A presentation slide with a dark background and a grid pattern. The title "Factors in Species Richness" is in a yellow box. Below it is a section header "Geographic factors:" followed by a bulleted list of three factors. The text "Understanding the Landscape" is at the bottom.

### Factors in Species Richness

Geographic factors:

- Altitude
- Latitude
- Depth (aquatic species)

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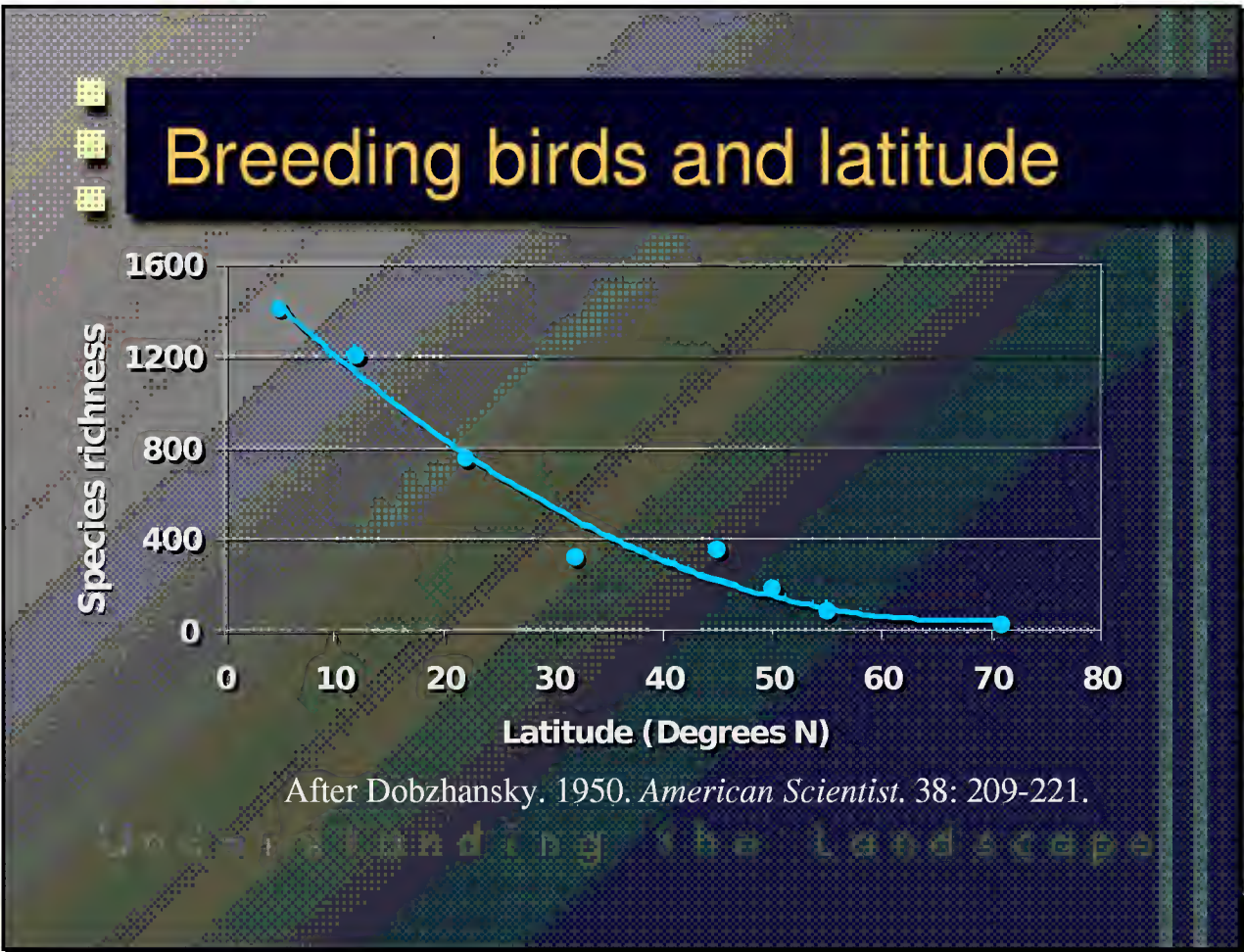
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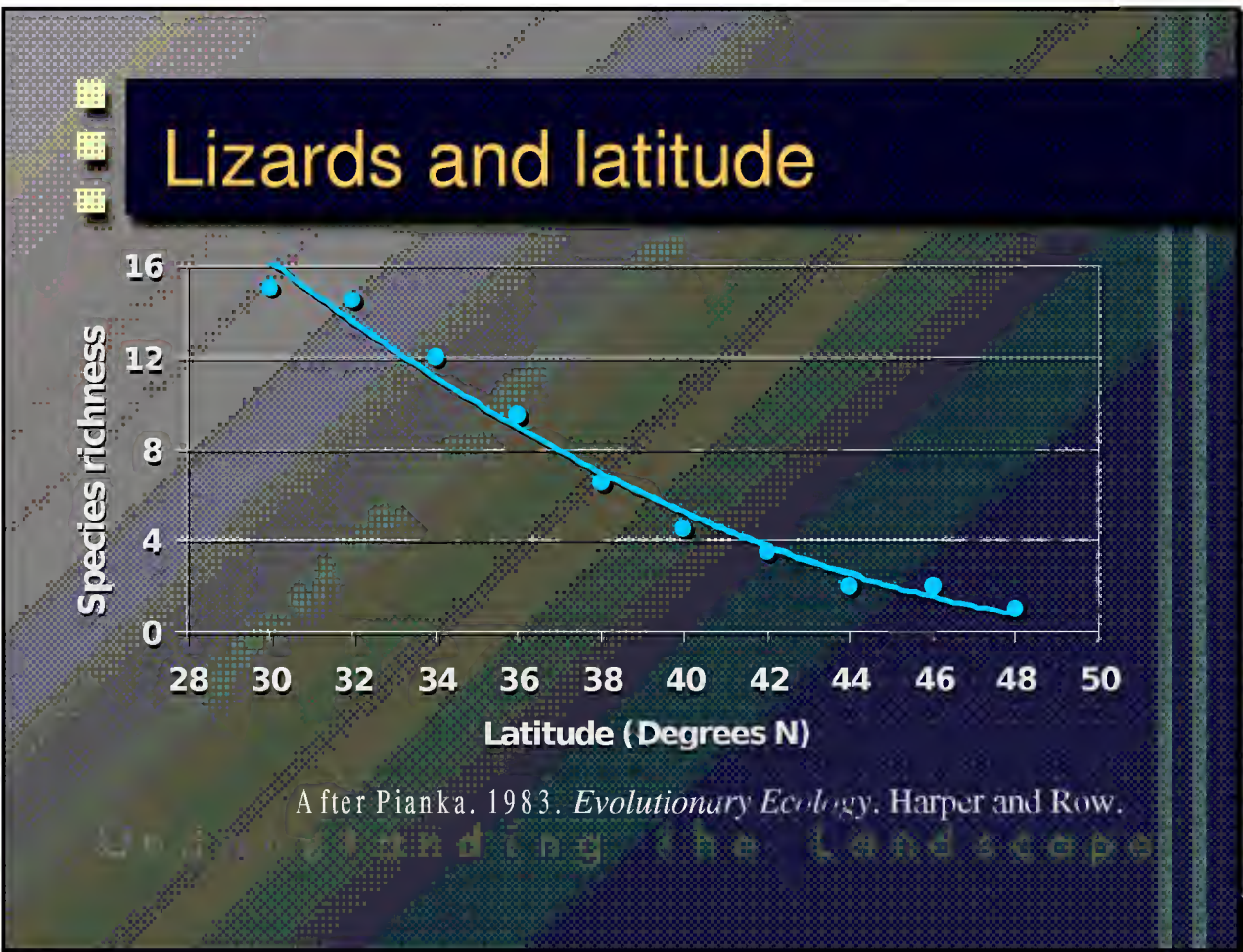
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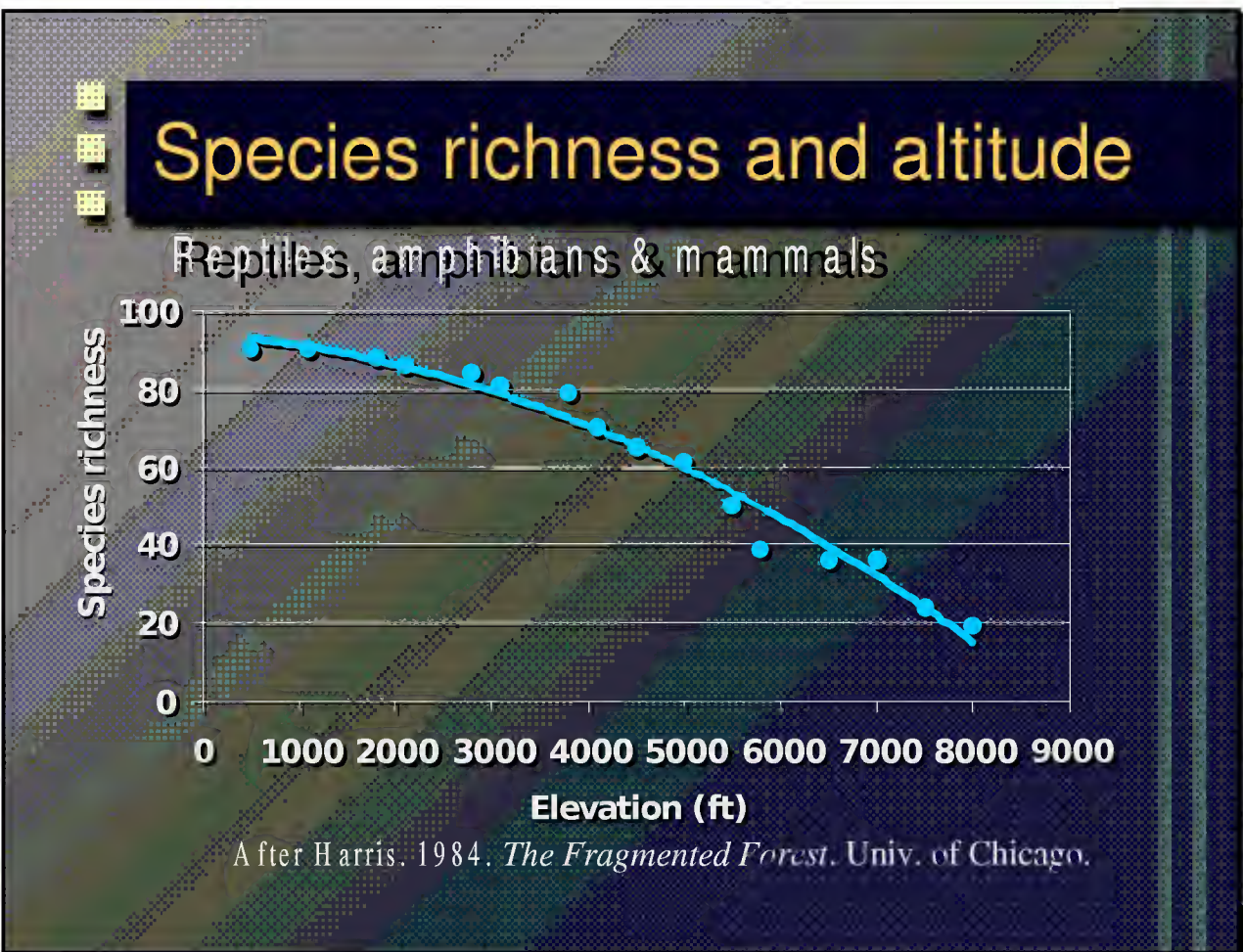
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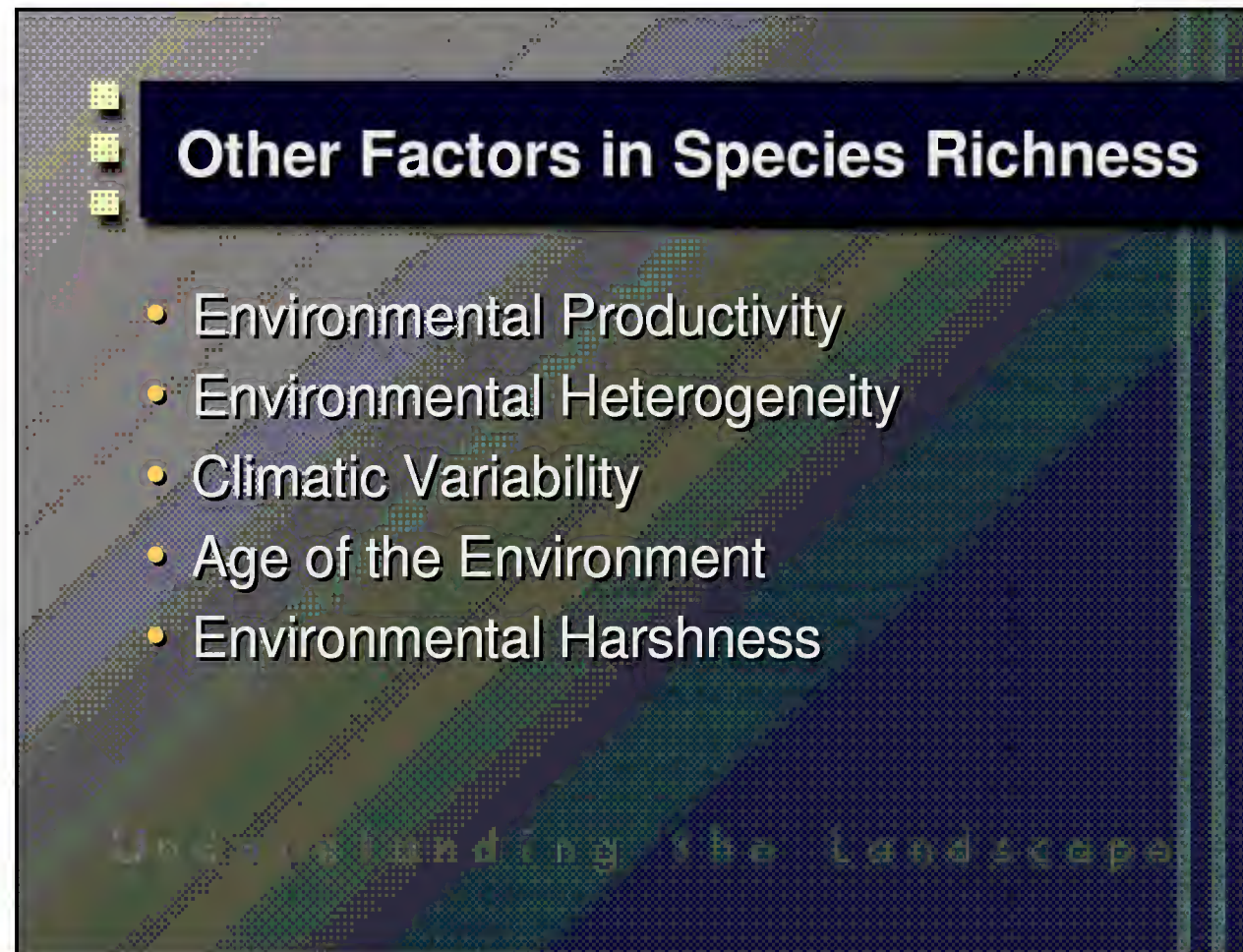
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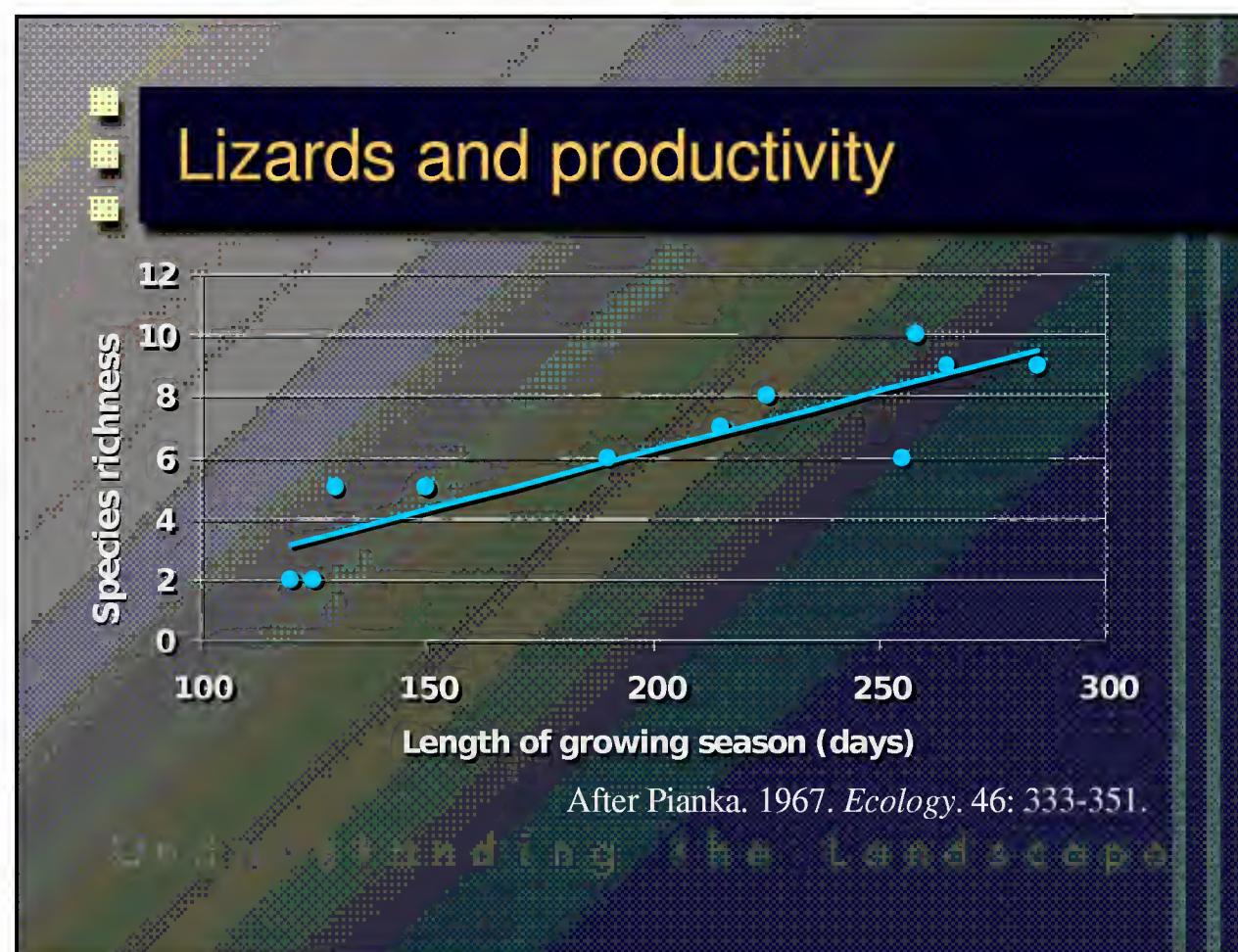
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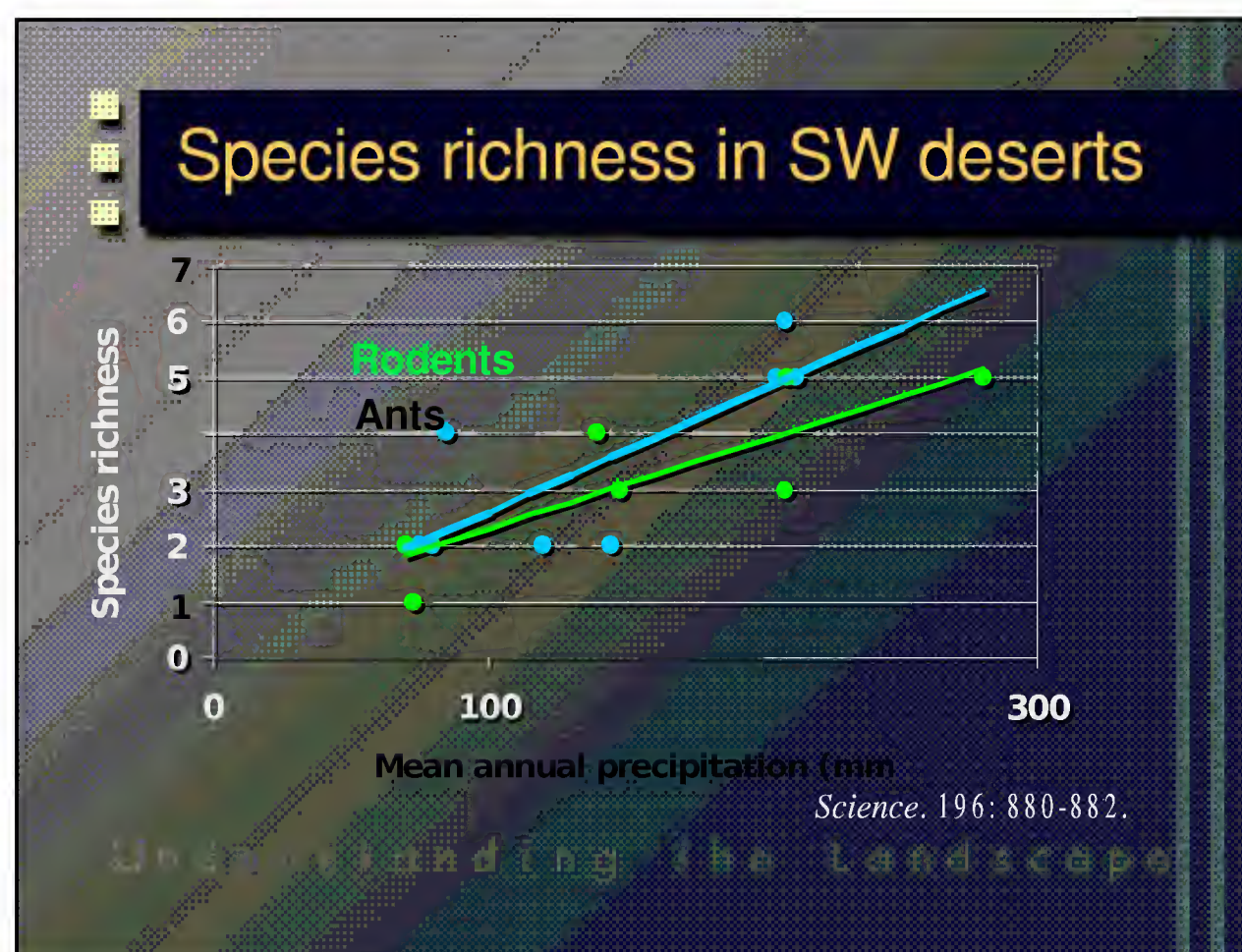
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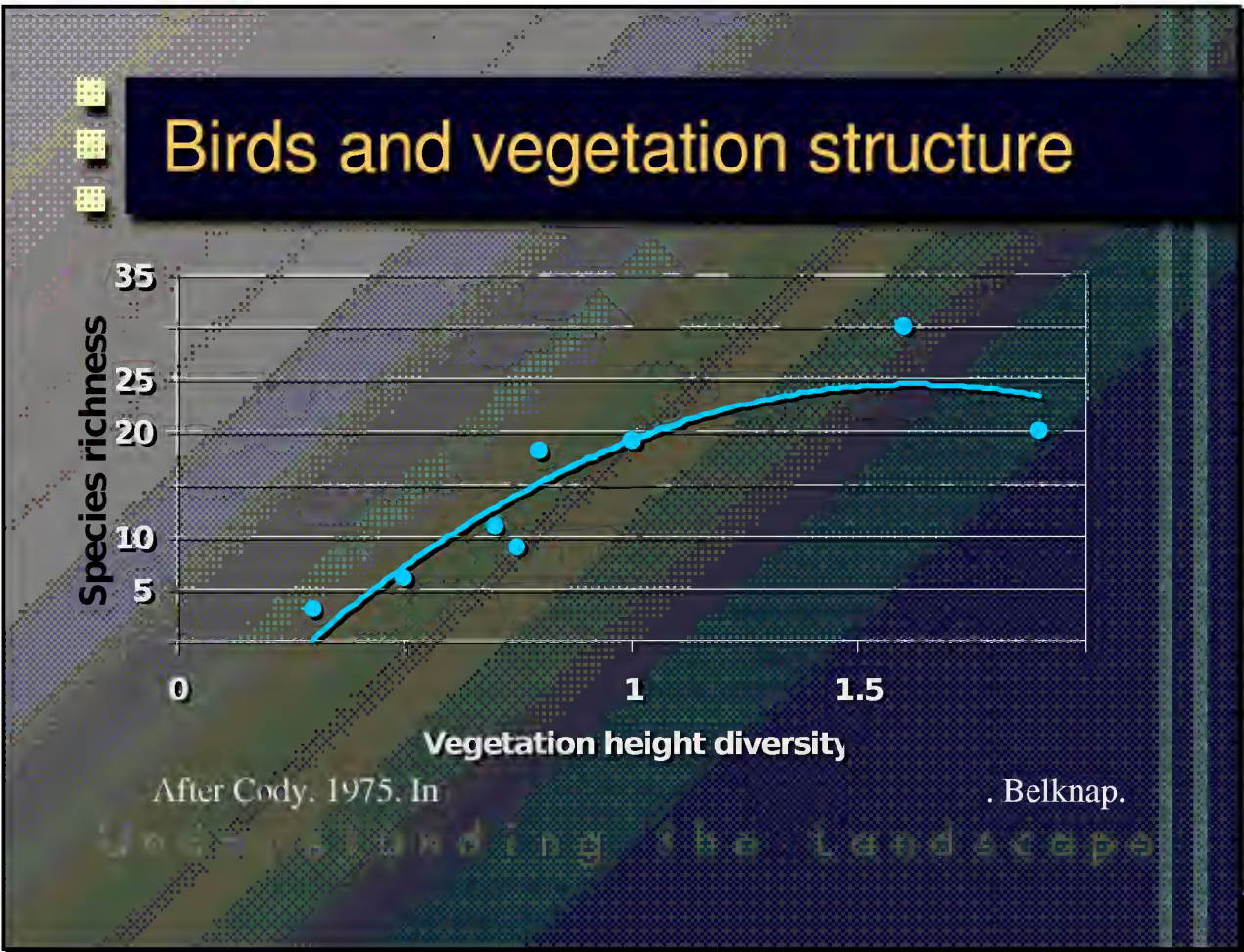
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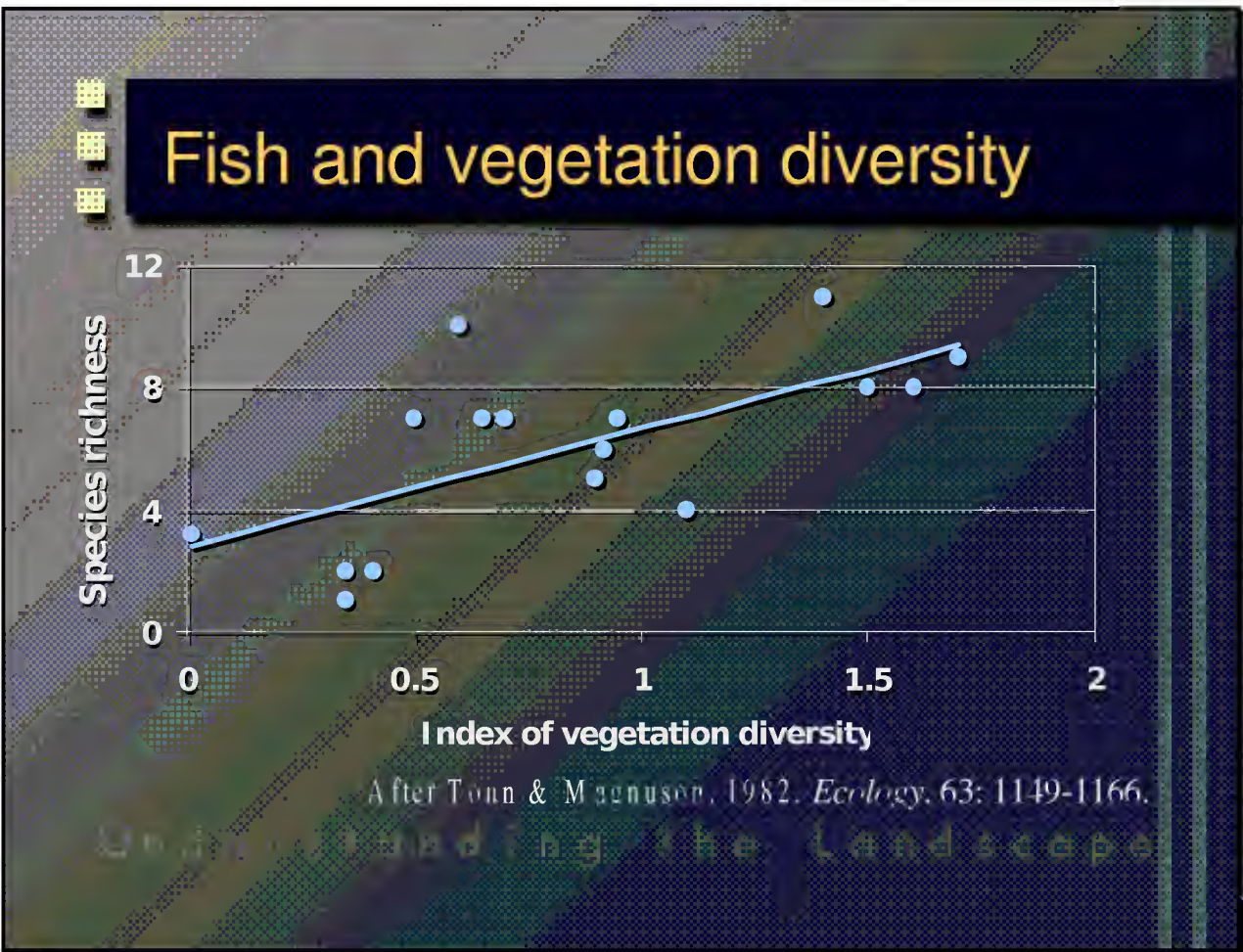
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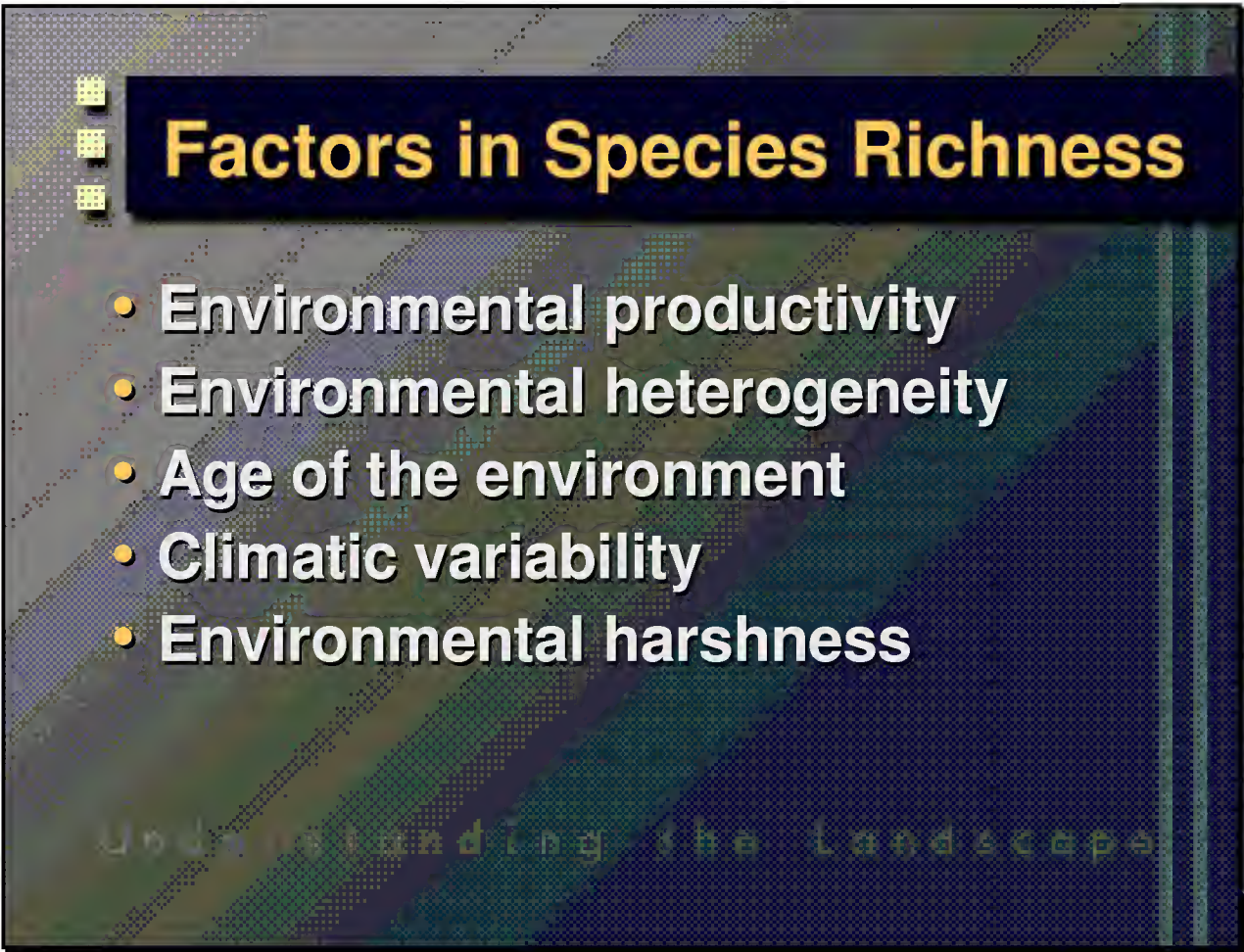
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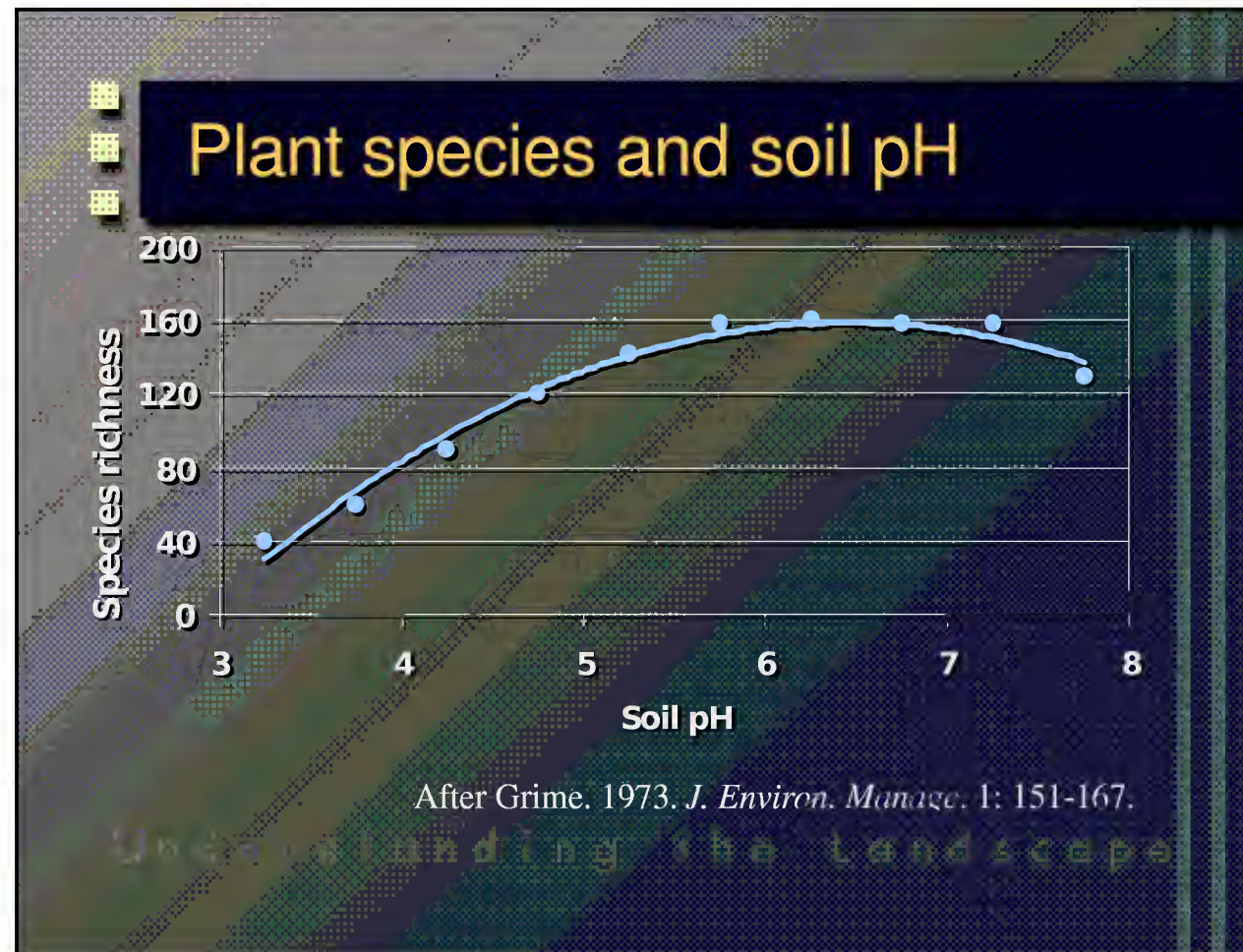
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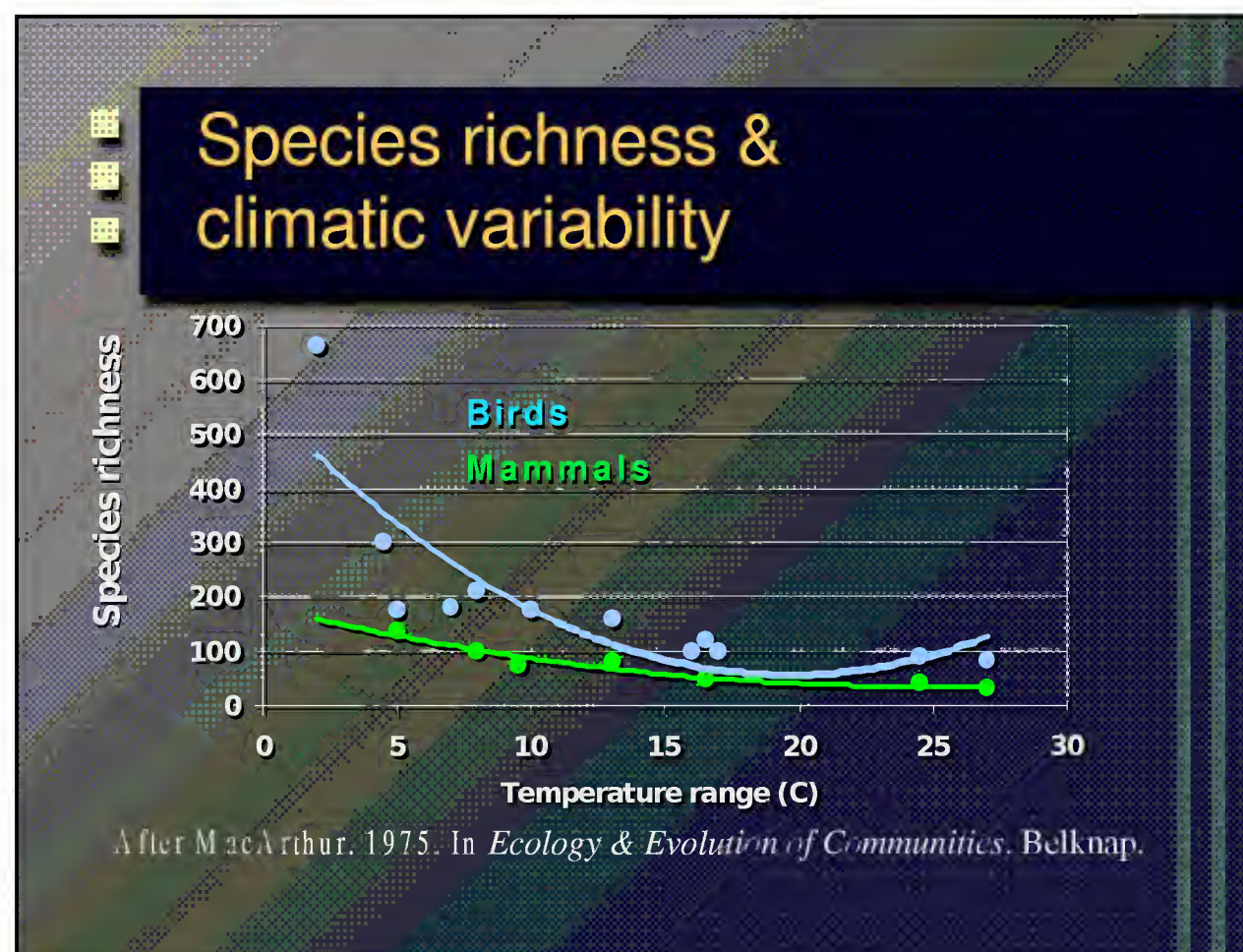
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### Implications for conservation planning

- Some areas are more important for conservation

Conservation efforts must include private lands

- important

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